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OP 1137

**60-MM MORTAR M2
FOR SHIPBOARD**



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O P 1137

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6 JANUARY 1945

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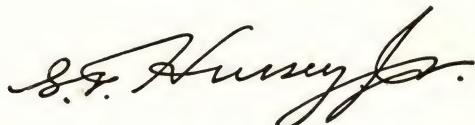
NAVY DEPARTMENT
BUREAU OF ORDNANCE
WASHINGTON 25, D. C.

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6 January 1945

**ORDNANCE PAMPHLET 1137
60-MM MORTAR M2 FOR SHIPBOARD**

1. Ordnance Pamphlet 1137 describes the 60-mm Mortar M2, and contains instructions for its use and maintenance on board ship.
2. This publication is intended for reference by all personnel concerned with the shipboard use of the 60-mm Mortar M2. The tactical use of this mortar is outside the scope of this pamphlet, and may be covered in publications from other sources.
3. This pamphlet does not supersede any existing publication. Reference should be made to U. S. Army Field Manual 23-85 and U. S. Army Technical Manuals 9-1260 and 9-2200.
4. This publication is RESTRICTED and shall be safeguarded in accordance with the security provisions of U. S. Navy Regulations, 1920, Articles 75½ and 76.



G. F. HUSSEY, JR.,
Rear Admiral, U. S. Navy
Chief of the Bureau of Ordnance

CONTENTS

| | Page | | Page |
|---|------|--|------|
| INTRODUCTION | | AMMUNITION | |
| What It Is | 5 | Identification | 17 |
| Its Purpose | 5 | Marking | 18 |
| General Description | 5 | General Description | 18 |
| Shipboard Mounting | 5 | Fin Assembly | 18 |
| General Data | 5 | Propellant Increments | 19 |
| DESCRIPTION | | Increment Holder | 20 |
| Barrel Assembly | 7 | The Primer | 21 |
| Bipod | 8 | High Explosive Shell, HE-M49A2 | 21 |
| The Leg Assembly | 8 | The Fuze | 21 |
| The Left Leg | 8 | Parts of Fuze PD-M52 | 21 |
| The Right Leg | 8 | Functioning of the Fuze PD-M52 | 23 |
| The Traversing Mechanism Assembly | 9 | Action of Fuze on Impact | 24 |
| Base Plate | 10 | 60-mm Illumination Shell M83 | 24 |
| 60-mm Mortar Base Adapter Mk 1 | 11 | Fin Assembly | 25 |
| Sight M4 | 11 | Illumination Shell M83 | 25 |
| OPERATION | | Illuminant Assembly | 25 |
| Shipboard Mounting and Dismounting | 12 | Parachute Assembly | 25 |
| Disassembly and Assembly | 13 | The Fuze M65 | 25 |
| Shipboard Operation of 60-mm Mortar M2 | 13 | Action of the Illuminating Shell | 26 |
| Safety Precautions During Operation | 13 | Practice Shell M50A2 | 27 |
| Sequence of Aiming, Loading, and Firing | 13 | Explosive Charge | 27 |
| Misfires | 14 | Training Shell M69 | 28 |
| MAINTENANCE | | Misfires | 28 |
| Cleaning and Care of 60-mm Mortar M2 | 15 | Shell Weight | 28 |
| Preparation for Stowage | 16 | Safety Precautions During Misfires | 29 |
| Cleaning and Care, Sight M4 | 17 | Care and Handling | 29 |
| | | Firing | 29 |
| | | Stowage | 30 |
| | | SAFETY PRECAUTIONS | 30 |

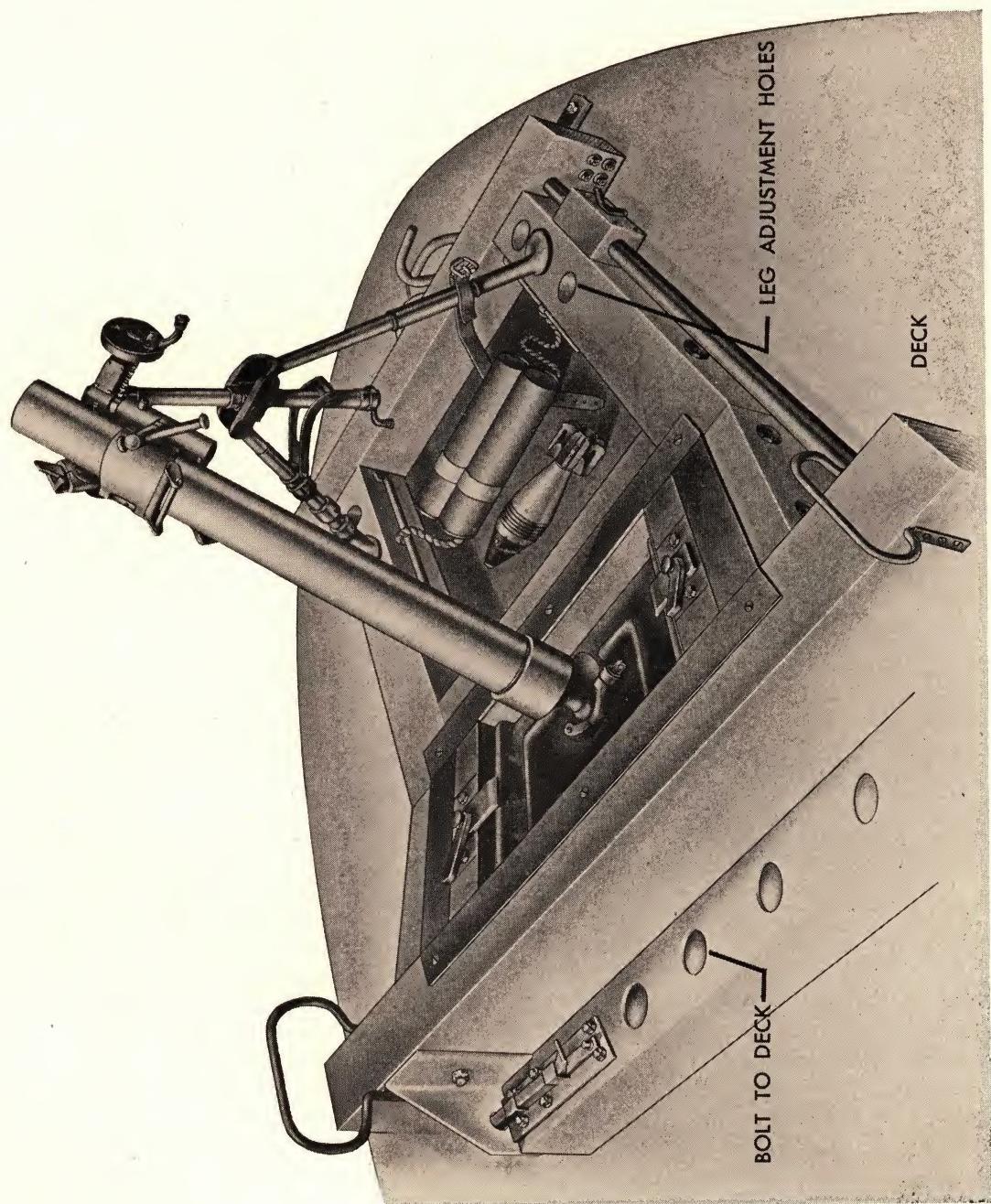


Figure 1. 60-mm Mortar M2 and Mortar Base Adapter Mk 1

60-MM MORTAR M2 FOR SHIPBOARD

INTRODUCTION

WHAT IT IS

The 60-mm Mortar M2 is a smooth-bore, muzzle-loading, portable weapon designed for high-angle fire.

ITS PURPOSE

The 60-mm Mortar M2 has been adopted by the United States Navy for use in firing high explosive and illuminating shells from PT boats and gunboats (PGM's). The mortar is removed from its shipboard base; the legs brought together, strapped securely, and stowed when use is not anticipated. In this stowed position, the mortar forms a portable unit which may be carried ashore if it is desired to supplement other ordnance in landing operations.

GENERAL DESCRIPTION

The mortar has two principal parts, the barrel and the mount. The barrel is assembled as a single unit, but the mount consists of two units, the bipod and the base plate. When mounted in the firing position, the barrel is secured near the muzzle by a clamp at the top of the bipod, and at the breech by a clamp in the base plate. This positions the barrel at an angle of not less than 40 degrees. Elevating and traversing mechanisms on the bipod permit elevation and horizontal movement of the barrel for aiming.

SHIPBOARD MOUNTING

The 60-mm Mortar Base Adapter Mk 1 (Fig. 1) is a wooden foundation for shipboard mounting of the 60-mm Mortar M2. This adapter, which is clamped to the deck, has an after compartment into which the mortar base plate is clamped, and leg adjustment holes at the forward end of the side members to receive the spiked feet of the bipod legs. Lines are attached to the side members for lashing the legs in position.

Once the mortar has been leveled, there is no need for further adjustment of the leveling mechanism, as both feet of the bipod remain in the same plane. The train position of the barrel is not changed, as the mortar is fired with the craft heading on the target. The only adjustment necessary is a change in the elevation of the muzzle in response to range orders.

GENERAL DATA

Weights

| | |
|------------------------|----------|
| Mortar, complete | 42 lb. |
| Barrel | 12.8 lb. |
| Bipod | 16.4 lb. |
| Base Plate | 12.8 lb. |
| Base Adapter | 175 lb. |

Length

| | |
|--------------------|----------|
| Mortar | 26.6 in. |
| Base Adapter | 53.5 in. |

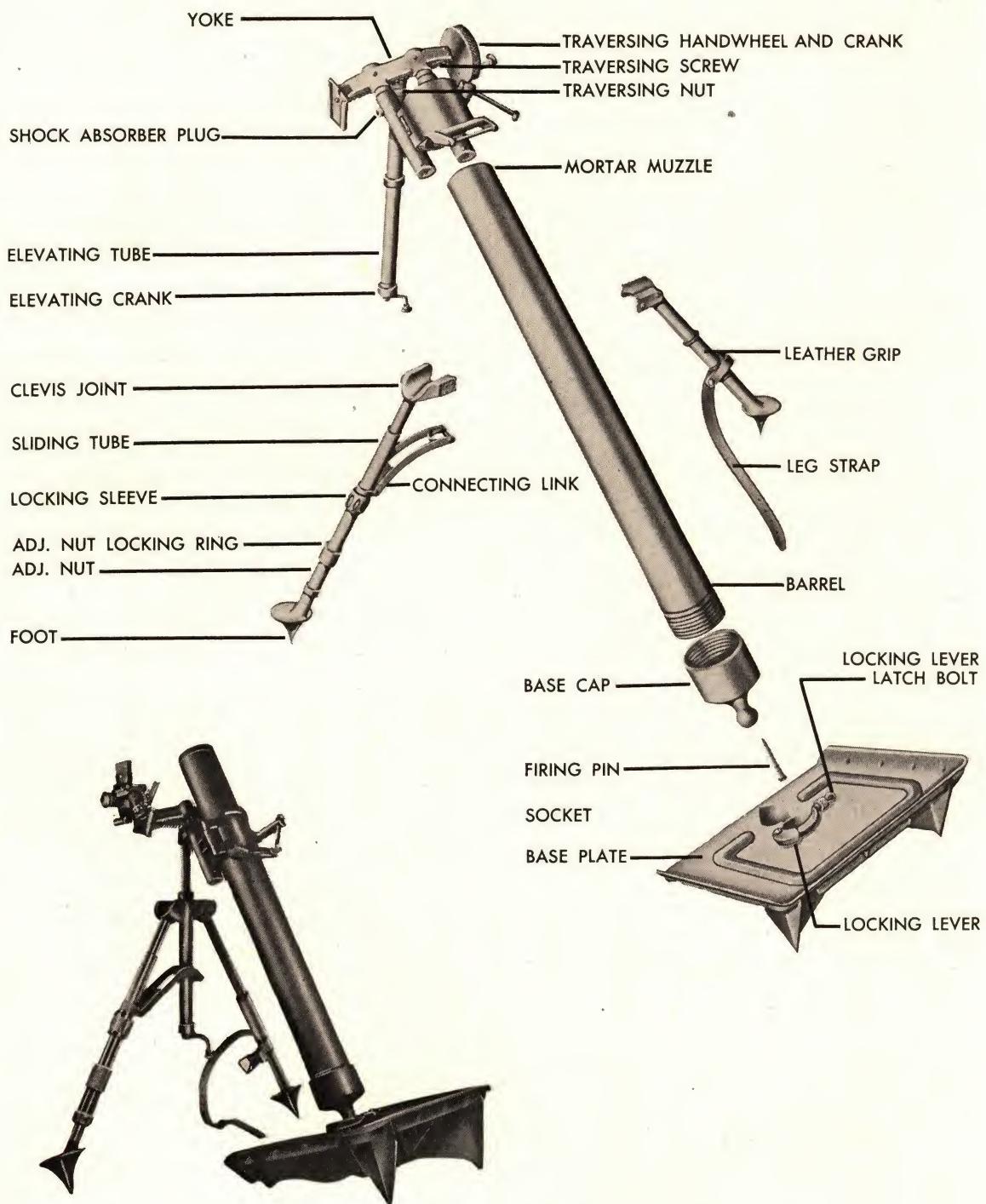


Figure 2. Component Parts 60-mm Mortar

DESCRIPTION

Width of Base Adapter 36 in.

Rate of Fire

Maximum rounds per minute ... 30 to 35
Normal rounds per minute 18

Elevations, approximately 40 to 85 degrees.

Range, Approximate

Shell, HE, M49A2 } 100 to 1,985 yds.
Shell, Practice M50A2 }

Travers, right or left, approximately 125 mils. One turn of handwheel, approximately 15 mils.

DESCRIPTION

The 60-mm Mortar M2 consists of the following parts, each of which is described hereinafter:

The Barrel Assembly

The Bipod, composed of the Leg Assemblies and the Traversing Mechanism Assembly

The Base Plate

Related equipment also described in this section includes the 60-mm Mortar Base Adapter Mk 1 and the Sight M4.

THE BARREL ASSEMBLY

The barrel assembly (Fig. 3) consists of the tube, the base cap, and the threaded firing pin.

The tube is bored smooth and is carefully finished to accurate dimensions on the in-



Figure 4. Base Plate

terior surfaces. The hollow base cap is threaded to screw onto the tube, closing the breech end. It terminates in a spherical projection which fits into and is locked in the socket of the base plate.

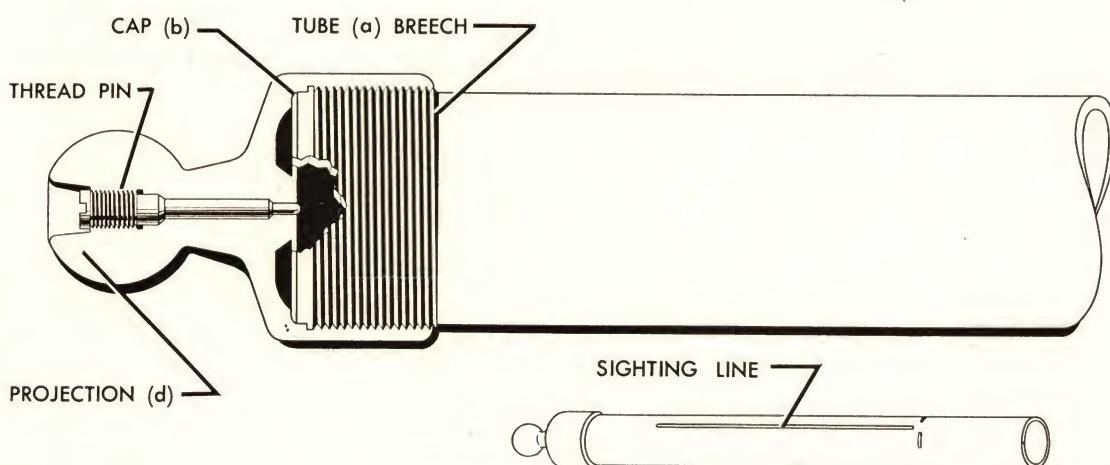


Figure 3. Barrel Assembly

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The point of the firing pin protrudes through the base cap into the breech of the tube.

On the outside of the barrel are a sighting line and a pair of secondary settings for the mortar clamp.

THE BIPOD

The bipod (Fig. 5) consists of:

- The Leg Assembly
- The Elevating Assembly
- The Traversing Mechanism

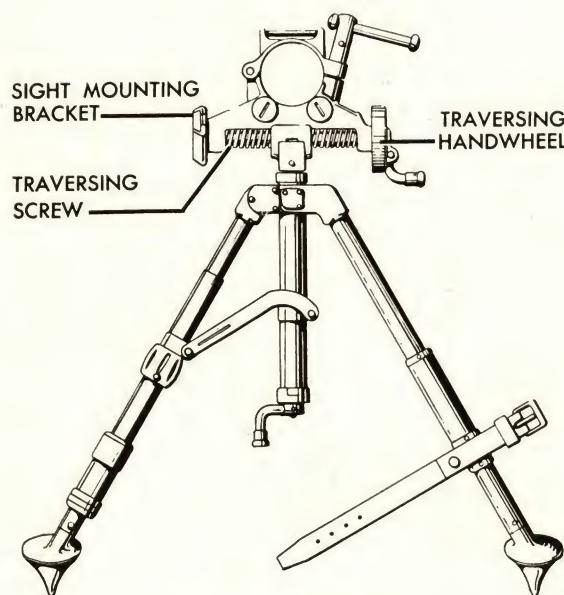


Figure 5. The Bipod

THE LEG ASSEMBLY

This is made up of two tubular steel legs (Fig. 6) connected by a clevis joint which limits the spread of the legs and locks them in an open position by means of a spring

latch on each half of the clevis joint. This joint is attached to the elevating guide tube by two clevis bearings. The legs terminate in spiked feet.

THE LEFT LEG

This leg is provided with a cross-leveling mechanism, consisting of a sliding bracket mounted on a sliding tube and joined by a connecting link to the elevating tube.

THE RIGHT LEG

This leg has no moving parts. Attached to the lower part are a leather hand grip and a strap. This strap secures the legs to the barrel to facilitate carrying and stowing.

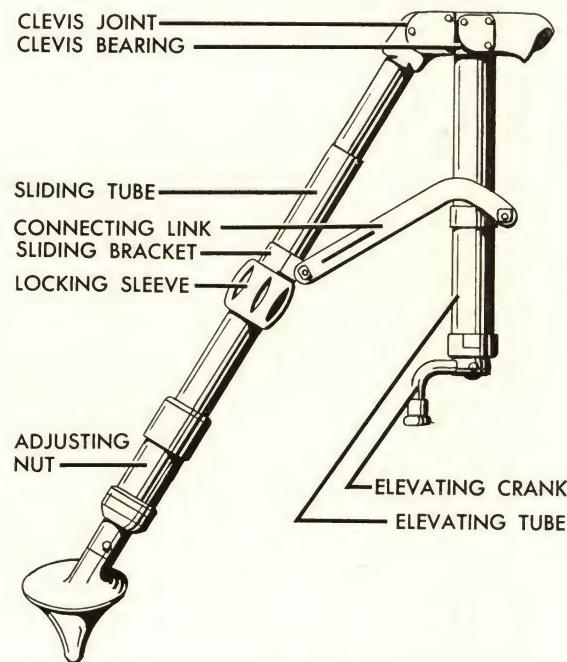
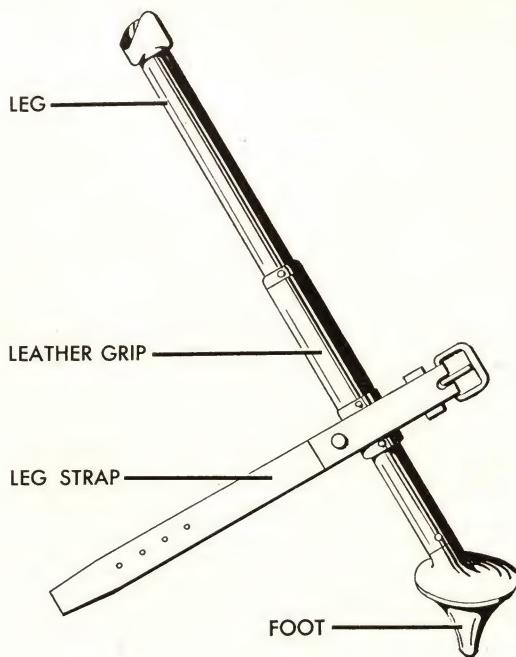
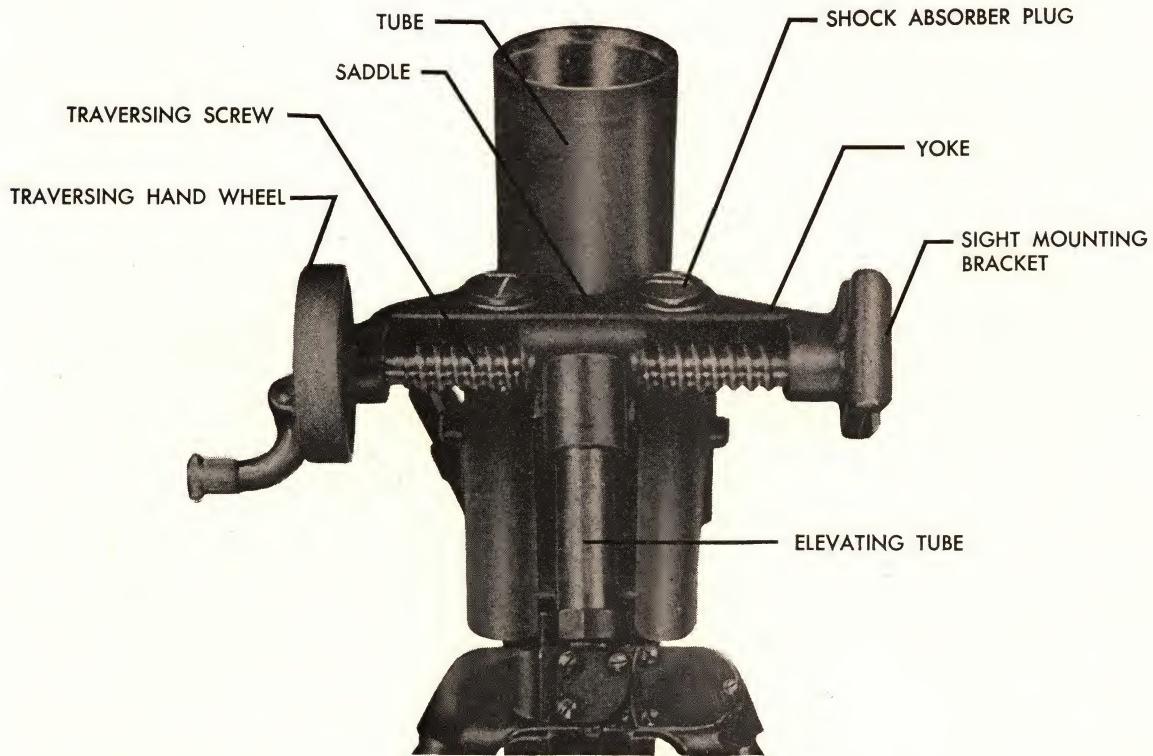


Figure 6. Left Leg Assembly

DESCRIPTION**THE TRAVERSING MECHANISM ASSEMBLY**

The traversing mechanism assembly (Fig. 8) consists of the traversing mechanism, the shock absorbers, and the mortar clamp. The traversing mechanism is made up of a traversing screw operating in a yoke. It is moved by the traversing handwheel. The yoke which provides the bearings for the traversing screw also serves as a connection between the mortar clamp and the elevating tube. It has a tapered dove-tail slot to receive the sight mounting bracket. The shock absorbers are designed to stabilize the mortar and mount during firing. They permit movement between the yoke and the collar. This movement is countered by the resistance of two coil compression springs located in the shock absorber retainers of the saddle.

**Figure 7. Right Leg Assembly****Figure 8. Traversing Mechanism Assembly****RESTRICTED**

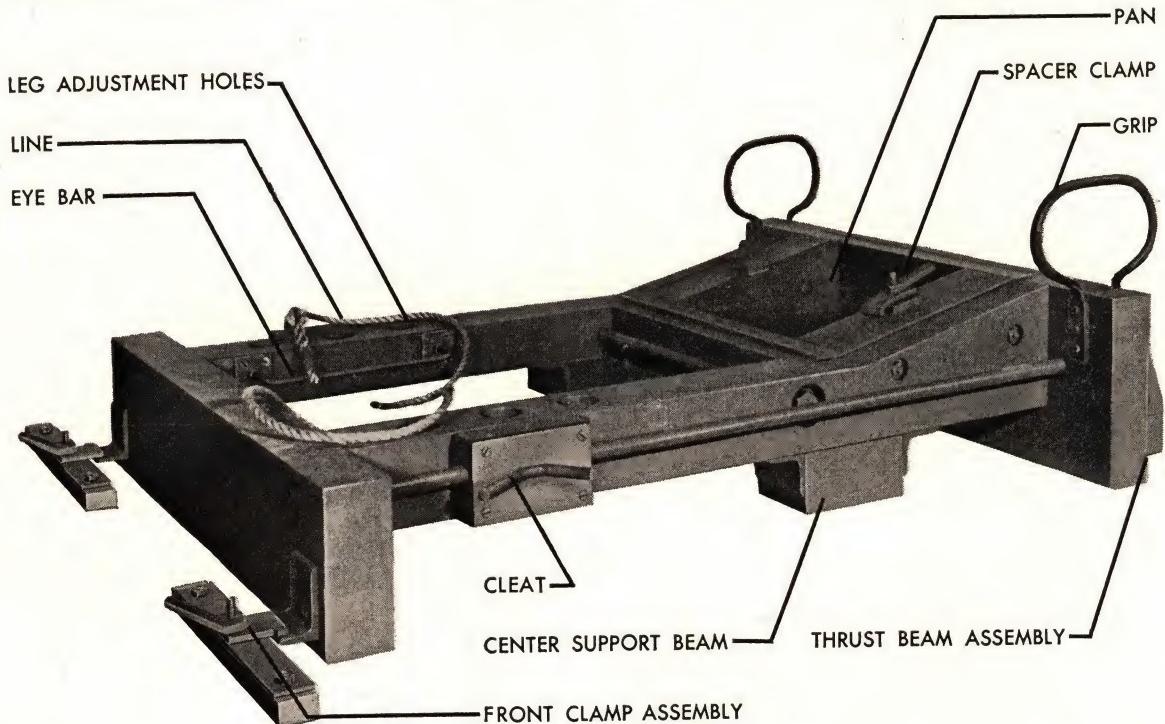


Figure 9. Mortar Base Adapter Mk 1

The mortar clamp which secures the bipod to the barrel is in two sections. The lower half is called the saddle; it includes two shock absorber retainers with locking screws. The upper half is called the clamping collar. The two halves of the clamp are hinged and can be locked tightly together by the mortar clamp bolt. When secured around the barrel, they lock it firmly to the bipod.

THE BASE PLATE

The body of the base plate, as shown in Fig. 10, is of pressed steel to which are welded a series of ribs and braces, the front flange, and the base cap socket. It has pointed projections on the bottom. The locking lever is mounted by a pivot to the socket.

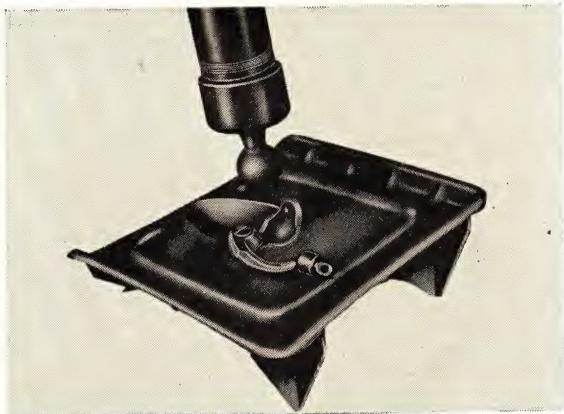


Figure 10. Base Plate

DESCRIPTION**60-MM MORTAR BASE ADAPTER MK 1**

The 60-mm Mortar Base Adapter Mk 1 (Fig. 9) is a deck foundation consisting of the following subassemblies:

- Wood framework assembly
- Two front clamp assemblies
- Pan assembly
- Two spacer clamp assemblies
- Thrust beam assembly

The wood framework assembly consists of two side members and a front cross member, with front clamp assemblies on either side for clamping the framework assembly to the deck.

The center support beams of the side members are to be adjusted so that they will be directly over a deck beam in installation. The pan assembly located in the after compartment of the base adapter is

equipped with two spacer clamp assemblies for mounting the base plate of the 60-mm Mortar M2. The thrust beam assembly at the after end of the base adapter is bolted to the deck directly over a deck beam by six $1\frac{1}{2}$ -in. step bolts.

The mortar is mounted in the base adapter by clamping the mortar base plate into the pan assembly and positioning the legs of the mortar bipod into the leg adjustment holes near the forward end of the side members. The legs are lashed in position by lines fastened to eye bars inside the side members and secured to cleats on the outside.

SIGHT M4

The Sight M4 (Fig. 11) is furnished with the mortar. It has the following parts:

- (a) The collimator
- (b) An open sight.

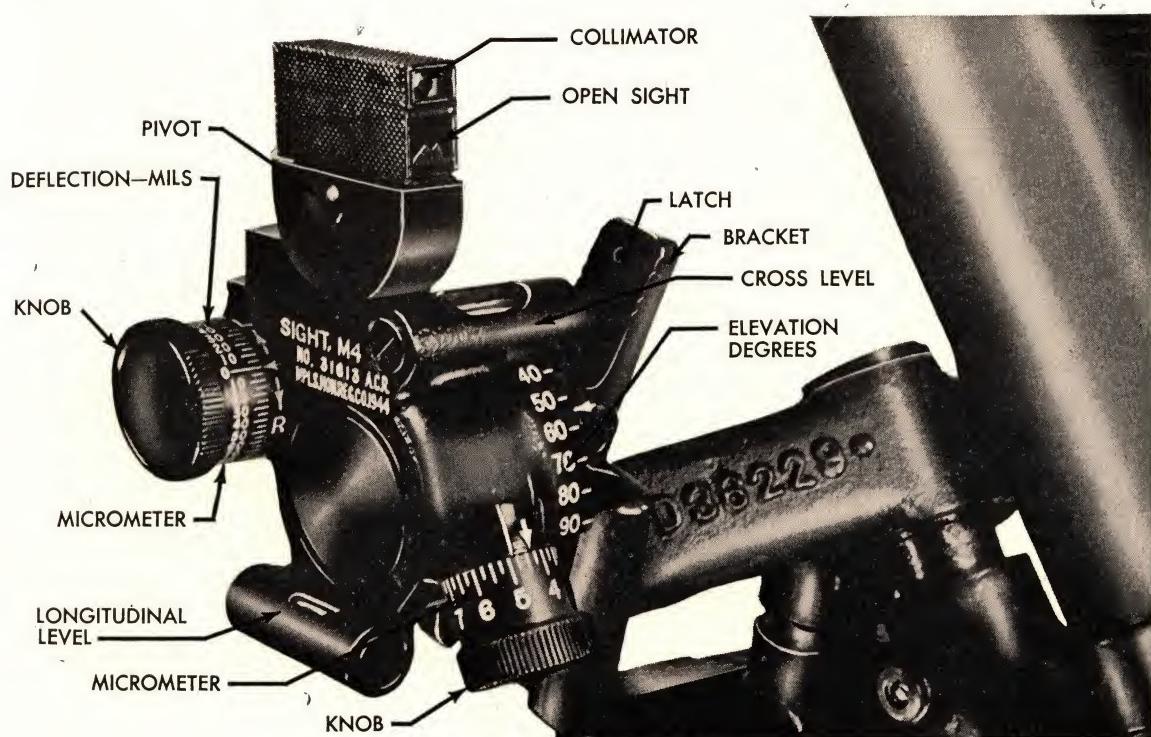


Figure 11. Sight M4

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- (c) The elevation deflection mechanism
- (d) The train deflection mechanism
- (e) A longitudinal level
- (f) A cross level

The collimator, or direction-sighting device, consists of a vertical translucent line in the opaque field of the eyepiece, enclosed in a rectangular tube. It is mounted over an open sight with a fixed vertical line. The collimator and the open sight pivot together to bring the aiming point within the field of view; this movement has no effect on elevation indications. When the sight is level, the collimator establishes a vertical line in the field of view. The line of sight with a

normal train deflection setting is parallel to the firing plane.

The levels, when centered, show that the mortar barrel is pointed in elevation and deflection at the position shown on the scales and micrometer.

Elevation deflection is indicated on a scale which is graduated in 10-degree steps. The scale is supplemented by a micrometer graduated in $\frac{1}{4}$ -degree steps.

Train deflection in mils is indicated on the micrometer scale, each graduation indicating five mils, going to 150 mils in either direction. The knobs have stops to limit their motion. They should never be turned beyond the limits established by these stops.

OPERATION

SHIPBOARD MOUNTING AND DISMOUNTING

Mounting

The thrust beam assembly and the front clamp assemblies are previously mounted on deck by the installation party in such a way that the center support beams and the thrust beam assembly are directly over deck beams. Shipboard mounting is completed as follows:

1. Clamp the mortar base adapter in position on deck.
2. Clamp the base plate into the pan assembly of the mortar base adapter.
3. With the bipod and mortar resting on the deck, unbuckle the leather strap and free the locking lever.
4. Insert the spherical projection of the mortar into the socket of the base plate and fasten the locking lever.
5. Move the bipod legs forward and pull them apart until the latch snaps into place.
6. Position the legs in the proper leg adjustment holes in the side members of the base.

7. Lash the bipod legs in position with the lines attached to the base, and secure the lines to the cleats on the outside of the side members.

8. Center the elevating screw nut by turning the elevating crank.

9. Center the traversing screw by turning the traversing handwheel.

10. Place the traversing crank in its inoperative position.

11. Remove the muzzle cover.

12. Mount the sight extension and sight on the mortar if immediate firing is anticipated. To mount the sight, insert the sight extension bracket into the dovetailed slot on the yoke of the mortar. When the sight is fully inserted, the latch will snap into place, securing the sight in position.

Dismounting

1. Remove the sight if it is still mounted.
2. Place the muzzle cover over the barrel.

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SOLICITORS

OPERATION

3. Turn the elevating crank counter-clockwise until the elevating screw is lowered into the guide tube.
4. Untie the lashing to free the bipod legs.
5. Unlock the barrel from the mortar base plate.
6. Lift the barrel and bipod legs out of the base adapter. Close the bipod legs, fold them against the barrel, and secure them in place with the leg strap.
7. Loosen the clamps securing the mortar base plate to the adapter and remove the base plate.
8. Stow the mortar and base plate in the designated place.

DISASSEMBLY AND ASSEMBLY

The only disassembly authorized on shipboard is the removal of the firing pin for cleaning or replacement, when necessary. To remove the firing pin, unscrew it from the base cap.

Replace the firing pin by screwing it tightly into position after cleaning it and lightly oiling the threads. If the point of the firing pin does not make contact with the projectile, it will not fire. To insure this contact, see that the firing pin is screwed in tightly enough to project the point into the tube.

SHIPBOARD OPERATION OF 60-MM MORTAR M2

Before loading and firing the following steps must be accomplished:

- (a) The mortar base adapter must be securely clamped to the deck and the mortar securely locked to the base plate.

(b) The mortar bolt clamp and the locking nut must be secure.

(c) The bore must be thoroughly clean.

(d) Each shell must be clean, particularly the bourrelet.

SAFETY PRECAUTIONS DURING OPERATION

1. Inspect from time to time to see that the clamp bolts and all locking nuts are tight.
2. Swab the bore after every five rounds.
3. To prevent bore prematures in firing the 60-mm, HE, Mortar shells fitted with fuzes PD-M52, test the tension of the safety pin spring by pressing and releasing the safety pin. It is important that no attempt be made to crowd in and retain a possibly unseated safety pin during loading. A quick verification of safety-pin seating is desired, and this is accomplished by pressing and releasing the safety pin. If the safety pin becomes unseated, the round shall not be fired but shall be placed in a safe location for destruction by ordnance personnel. Extreme care shall be taken in handling such rounds, since they are armed and detonation will result if pressure is applied to the firing pin. When testing the safety pin of the Fuze PD-M52, the shell should be held in a vertical position with the fuze end up.

SEQUENCE OF AIMING, LOADING, AND FIRING

1. A gunner takes position at the left or right side of the mounted mortar while an ammunition handler with the ammunition takes position near the gunner. The normal position for the gunner during these operations is seated or crouching.

2. The gunner latches the sight extension bracket to the dovetailed slot on the yoke of the mortar.

3. The gunner sets the sight for the desired range. Instructions for elevation may be given either in the number of turns of the adjusting screw or in yards. When the range is given in yards, the elevation scale knob is turned to the elevation figure for that range found on the permanent firing table. For example, with a target range of 800 yards, according to the permanent firing table the elevation scale knob should be set at 56. The barrel is set at this elevation by turning the elevating crank until the bubble in the longitudinal level is centered as nearly as motion of the craft permits.

In combat, the sight is not used after the first elevation setting. As the craft approaches the target, changes in elevation may be necessary because the barrel must be raised for shorter ranges. Observation of the burst may also indicate the need for elevation changes. These changes are estimated, and the elevating crank is given the required number of turns. Under certain conditions, the gunner may take advantage of the pitch of the craft for changes in elevation.

4. The gunner elevates the barrel in accordance with the range ordered. Laying for elevation is accomplished by selecting the proper foot holes in the base adapter for the bipod legs, and by manipulating the elevating crank until the bubble in the longitudinal level is centered as nearly as motion of the boat permits. **Check by sighting along the barrel to see that the path of the projectile clears any boat's structure or other interference.** Elevation is the only adjustment required for aim in shipboard use, since the train position is determined by the position of the craft.

5. The gunner removes the sight.

6. The ammunition handler prepares the ammunition for firing by adjusting the propellant charge for the range to be fired.

The full charge for maximum range consists of an ignition cartridge and four equal propellant increments (bundles of sheet powder) assembled to the base of the round as issued. The increments are fitted between the blades of the fin. To prepare the charge for firing shorter ranges, it is necessary to remove those increments not required.

7. The ammunition handler hands the prepared round to the gunner.

8. The gunner withdraws the safety wire from the fuze.

Note 1: Do not remove the fuze safety wire until immediately before firing.

Note 2: Before loading shells fitted with fuzes PD-M52, test the tension of the safety pin spring by pressing and releasing the safety pin. It is important that no attempt be made to crowd in and retain a possibly unseated safety pin during loading. A quick verification of safety-pin seating is desired, and this is accomplished by pressing and releasing the safety pin. If the safety pin becomes unseated, the round shall not be fired but shall be placed in a safe location for destruction by ordnance personnel. Extreme care shall be taken in handling such rounds, since they are armed and detonation will result if pressure is applied to the firing pin. When testing the safety pin of the Fuze PD-M52, the shell should be held in a vertical position with the fuze end up.

9. The gunner inserts the ready round, fuze end up, into the muzzle of the mortar. Upon releasing the shell, withdraw the hand to the rear immediately.

MISFIRES

For procedure in event of misfires, refer to page 28 under the ammunition section of this pamphlet.

MAINTENANCE**MAINTENANCE**

Maintenance of the mortar for the best efficiency requires that it be assembled properly, that all moving parts be lubricated thoroughly, and that all bolts and retaining nuts be set correctly and kept tight.

Assembly is covered on the preceding page, and lubrication is included under "Cleaning and Care" in this section. Malfunctions due to wear and the correction required in each case follow:

Malfunction

1. Gas leakage through cap projection.
2. Failure of the firing pin to contact the projectile.
3. Failure of legs to lock in spread position.
4. Binding or sluggish operation of moving parts.
5. Insecurity of base cap in socket of base plate.
6. Back lash in left leg assembly.
7. Lost motion in traversing mechanism.

Correction

1. See that the firing pin is screwed in tightly. Replace with a new one if the threads of the pin show excessive wear.
2. Same as 1 above.
3. Replace the latch springs in the clevis joint.
4. Clean and oil the moving parts.
5. Replace the base plate latch spring.
6. Replace the tension nut spring.
7. Replace the tension nut spring.

**CLEANING AND CARE OF
60-MM MORTAR M2****Before Firing**

(a) Clean the bore and firing pin with clean dry waste.

Do not apply any oil to these parts before firing.

(b) Thoroughly clean with dry cleaning solvent, Federal Specification P-5661a, and

lightly oil all metal moving parts with light preservative lubricating oil (Navy Specification OS 1361 or 1362).

Do not use grease.

After Firing

(a) Clean the bore not later than the evening of the date of firing, and for three consecutive days thereafter.

(b) After the bore is thoroughly clean, swab it with light preservative lubricating oil.

(c) Clean the outside of the barrel with soap solution or dry cleaning solvent P-5661a, rinse with clear water, and dry thoroughly.

(d) Unscrew the firing pin and clean both the vent and the firing pin with clean, dry cotton waste. Then coat them lightly with light preservative lubricating oil.

(e) Brush all screws and crevices with a small cleaning brush.

(f) Clean all surfaces with a dry cloth and lightly oil with light preservative lubricating oil.

(g) Operate the traversing handwheel and elevating crank in order to distribute the oil over the working surfaces.

PREPARATION FOR STOWAGE

(a) Clean the bore, firing pin, base cap, and all parts of the bipod, and the exterior of the mortar as detailed above. Then completely dry with a clean, dry cloth.

(b) Without allowing the bare hands to touch the cleaned and dried metal parts, coat them lightly with light preservative lubricating oil.

(c) Stow the mortar, handling it with oiled cloths. Under no circumstances will a mortar be stowed in a cloth or any other moisture-absorbing cover or with a plug in the bore.

When not in use, inspect the stowed mortar every five days and clean and lubricate as required by its condition.

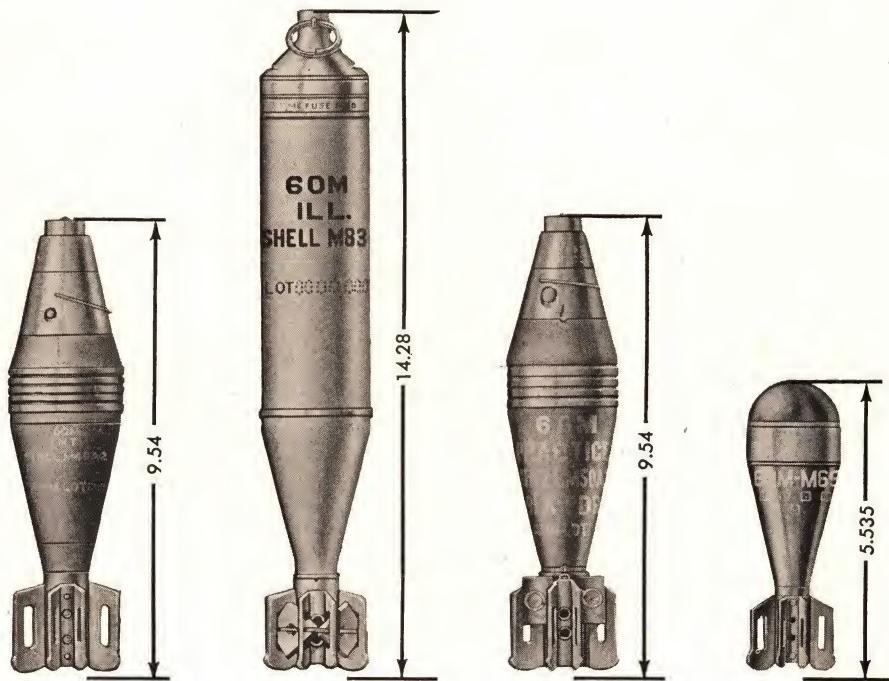


Figure 12. Comparison of Sizes of 60-mm Mortar Ammunition

AMMUNITION**CLEANING AND CARE, SIGHT M4**

- (a) Always handle the sight with care to avoid burring or denting the locating surface of the sight bracket and mortar yoke.
- (b) When not in use, keep the sight in the carrying case.
- (c) Keep the sight as dry as possible; never stow it wet.
- (d) No disassembly of the sight is authorized.

(e) Keep the optical parts of the collimator clean and dry by wiping with lens tissue or soft paper.

Under no conditions will polishing liquids, pastes, or abrasives be used for polishing optical parts.

(f) Occasionally oil the exposed moving parts of the sight with a small quantity of light preservative lubricating oil. Keep the dovetailed surface of the mortar yoke lightly coated with refined petrolatum. Keep excess lubricant that seeps from the moving parts wiped off to prevent accumulation of dust and grit.

AMMUNITION

Information in this section pertaining to the complete rounds of semi-fixed ammunition authorized for use in the 60-mm Mortar M2 includes a description of the round, means of identification, care, use, and ballistic data.

Based upon use, the principal classifications of ammunition for this mortar are:

- (a) High explosive (HE) for use against personnel and light material targets
- (b) Illuminating, for the illumination of objectives not within the range of other ground forces

- (c) Practice
- (d) Training

IDENTIFICATION**(a) Marking on fiber containers**

The markings on the container identify the contents. An ammunition data card inside the container gives additional information about the round.

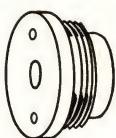
(b) Color of projectile

All projectiles are painted to prevent rust and to identify the type. Color designations used are:

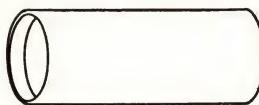
- | | |
|---|----------------|
| 1. Olive drab, with yellow markings | High explosive |
| 2. Gray, marked in black | Illuminating |
| 3. Black, with white markings | Training |
| 4. Blue, with white markings | Practice |

MARKING

When removed from the fiber container, the complete round can be identified by the following information stenciled on it:

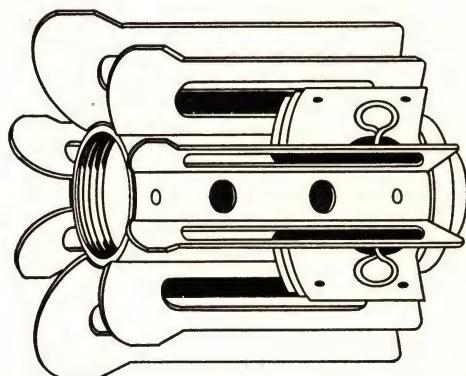


PRIMER



CARTRIDGE

1. Caliber of mortar with which it is fired
2. Kind of filler
3. Model of shell
4. Ammunition lot number



CARTRIDGE CONTAINER WITH WELDED ON FIN

Figure 13. Fin Assembly**GENERAL DESCRIPTION**

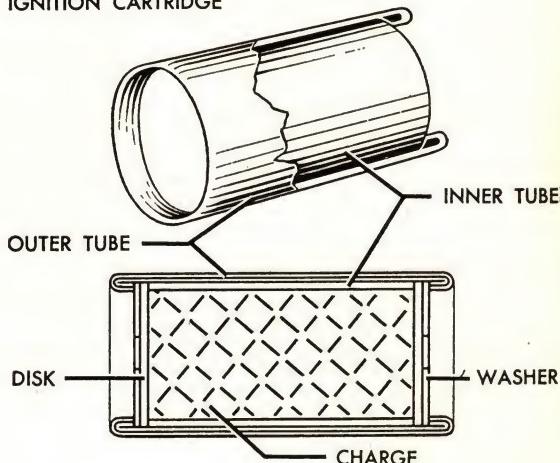
With the exception of the Training Shell M69, the ammunition used with the 60-mm Mortar M2 has the same principal parts: the fuze, the body, and the standard fin assembly. The training shell is not equipped with a fuze. Each type of shell has a different body, but they all have a threaded rear cavity to receive the fin assembly.

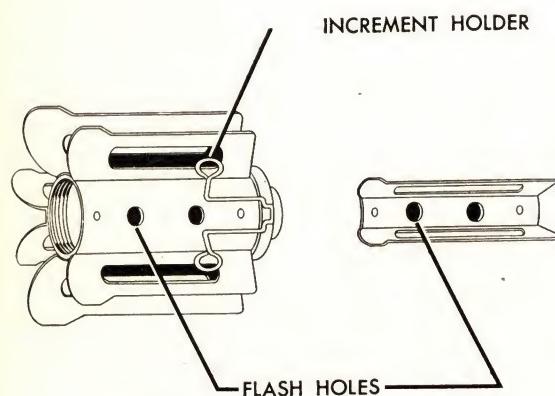
FIN ASSEMBLY

The fin assembly is designed to house the propelling charges and to stabilize the projectile while it is in flight. It has two principal parts, the cartridge container and

the four double-bladed fins which are welded to it. The entire assembly weighs 0.43

IGNITION CARTRIDGE

**Figure 14. Cartridge Assembly**

AMMUNITION**Figure 15. Increment Holder**

pound and screws into the rear cavity of the shell body.

The cartridge container is a steel tube closed at one end. A threaded projection at the closed end fits the recess in the lower end of the shell body. The open end is threaded to receive the primer, which is screwed into place when the cartridge is in the cartridge container. The container is 2.4 in. long and has an inside diameter of 0.65 in. Eight pairs of holes are drilled through the walls of the container to permit the escape of burning gases.

The cartridge is made of two paraffined cartridge paper tubes.

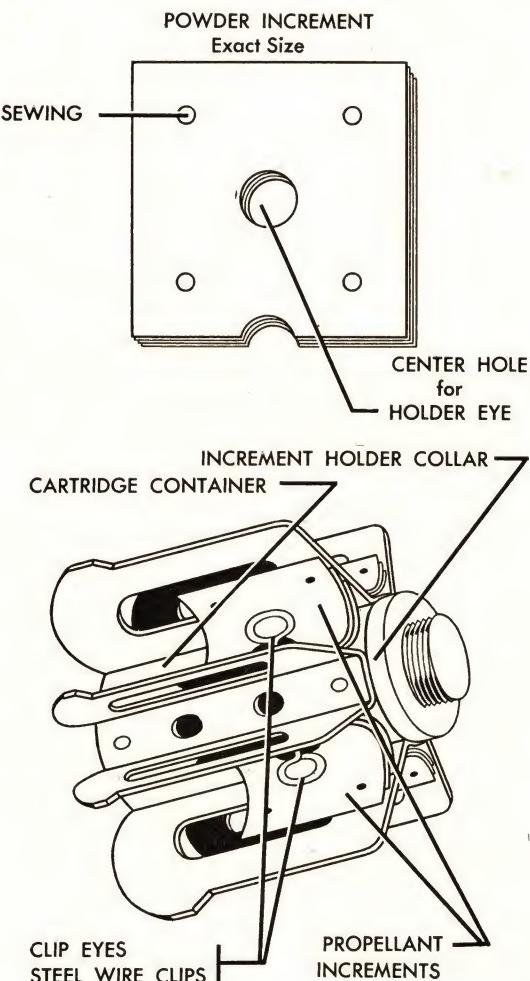
The inner tube holds a 47-grain charge of propellant powder. The outer tube is closed by discs and washers. The crimped ends of the paper are sprayed with nitro-cellulose lacquer to hasten ignition.

The double-bladed fins are shown in Fig. 13. Each fin is formed and punched and then welded to the cartridge container, so

that the holes in the fins align with the flash holes in the container.

PROPELLANT INCREMENTS

These increments are made of propellant powder in flake form. Ordinarily 10 flakes are sewn together to bring the weight of the increment to approximately 35 grains. Four of the increments, one for each of the fins, are included in the fin assembly. The force of the explosion of the powder in the

**Figure 16. Fin Assembly and Powder Increments**

cartridge and the propellant increments fires the shell at a muzzle velocity which varies with the number of increments attached. If no increments are added (the cartridge alone firing the shell), the velocity is 225 feet per second. When the cartridge is augmented by four increments, the muzzle velocity is 518 feet per second. Thus, the mortar can be fired at different ranges without changing the elevation of the gun by adding or removing increments. A firing table showing charges that are used for different ranges is included in the container with each round.

INCREMENT HOLDER

The collar and the two steel clips of the assembly are designed to hold the incre-

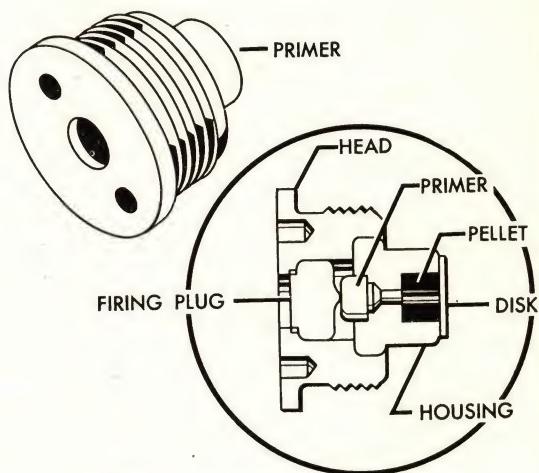


Figure 17. Primer Assembly

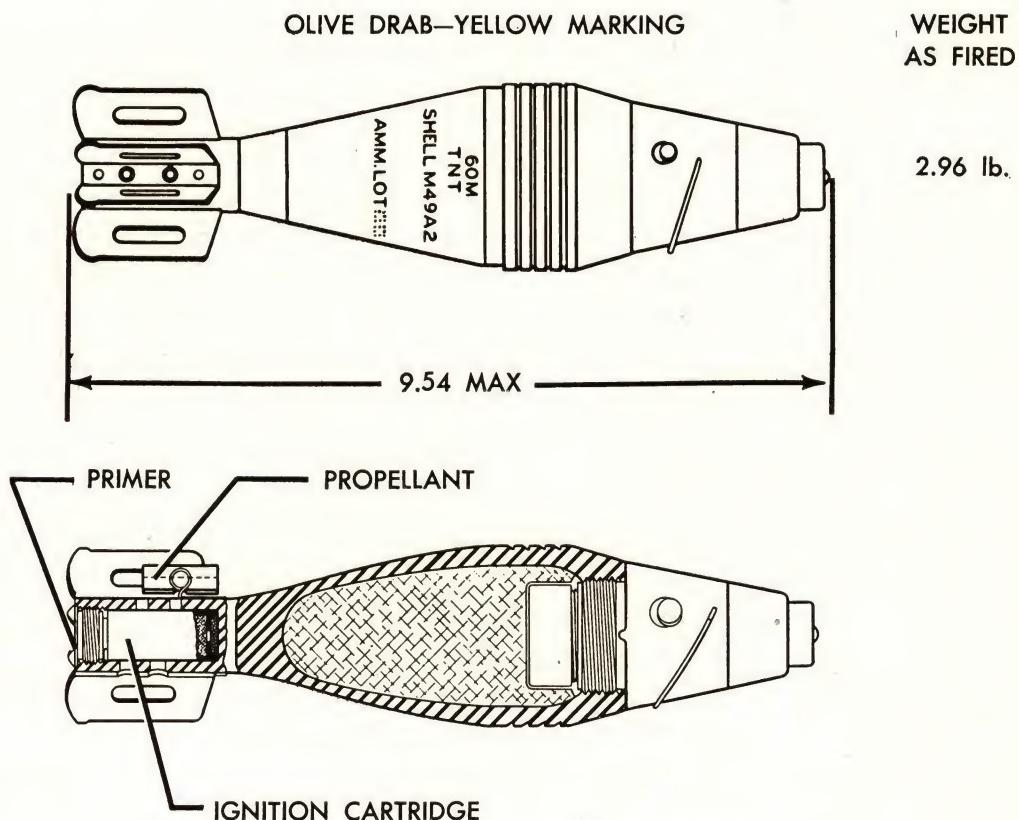


Figure 18. High Explosive Shell M49A2

ments firmly. The collar (A) is fitted and welded about the cartridge container (B). On opposite faces, sections of the collar are pressed out to form loops. The clips (C) are crimped into the loops. The clips extend to the rear, then bend sharply towards the outer edges of the fins. The ends of the clips are formed into eyes (D) which are engaged in the holes of the propellant increments (E), holding them in place.

THE PRIMER

The primer is screwed into the rear opening of the cartridge container and positioned so that it receives a sharp blow from the firing pin when the round is dropped down the barrel. The blow actuates the primer, which ignites the ignition cartridge. The flames of the burning powder flash out through the holes of the cartridge container and the fins. This in turn ignites the propellant increments. The gases from the burning increments, unable to escape from the barrel because of the bourrelet, force the shell out of the barrel.

Service ammunition supplied for the 60-mm Mortar M2 consists of the Shell HE-M49A2, with Fuze PD-M52, a superquick, point detonating type, and the Illuminating Shell M83 and M83A1 with Time Fuze (Fixed) M85. Under normal conditions, the two service rounds are issued in the theater of operations in the proportions of 97% HE, and 3% illuminating shell. The practice round and the training round are suitable for practice and drill firing purposes only.

New types of 60-mm ammunition issued include:

1. Shell, Smoke, HC, B1, T8 for 60-mm Mortars M1 and M2
2. Shell, Smoke, Phosphorus, WP, T6 W/Fuze PD-M52 B1E2

HIGH EXPLOSIVE SHELL, HE-M49A2

This shell is a standard service, high explosive, fragmentation round. It consists of a body containing a TNT explosive charge, a point detonating fuze, and the standard fin assembly. The effective area of burst covered by the shell when striking the ground at an angle of fall of 70 degrees is 11.3 yards in diameter. The quick action of the fuze permits little or no tunneling action.

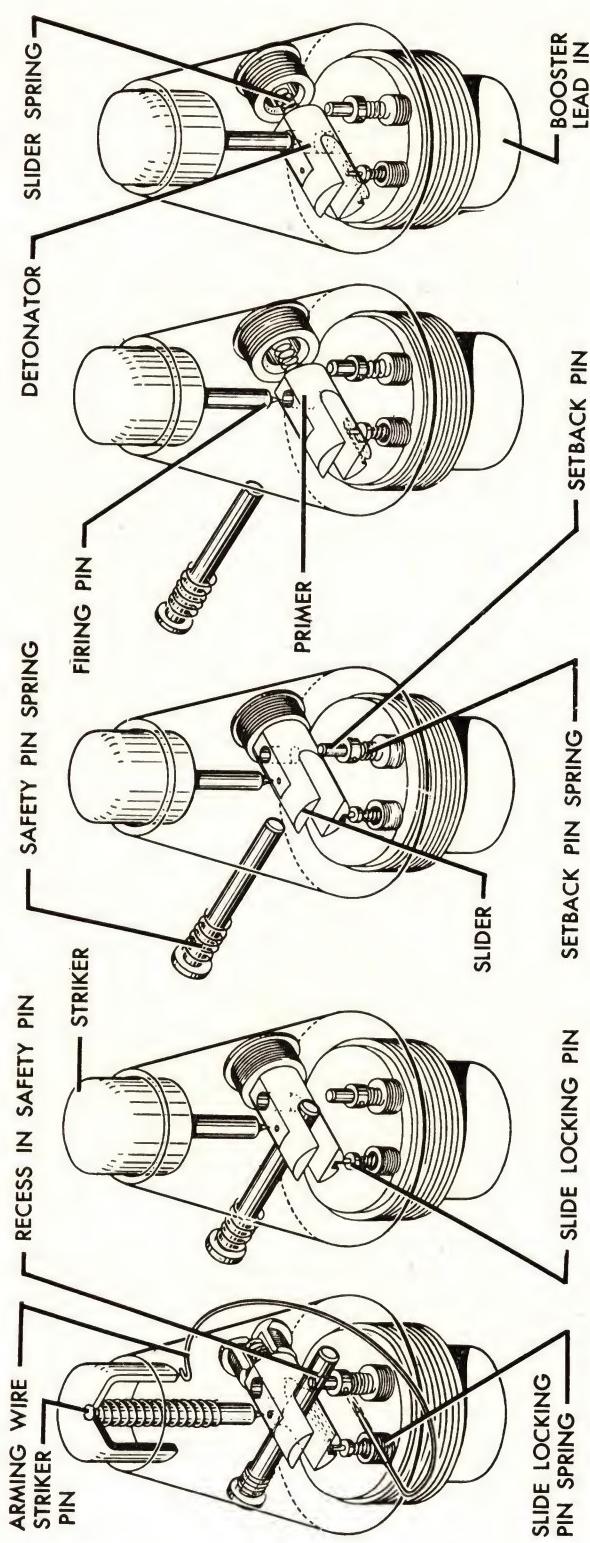
The body of the shell is made of steel and weighs no more than 1.67 pounds. The forward end is threaded to receive the fuze, and the rear cavity is threaded to receive the primer.

THE FUZE

This standard fuze, a superquick, is identified by PDF-M52 stamped on the body. The superquick fuze is designed to function before any penetration occurs, permitting the maximum surface effect of fragmentation of the shell. For use in the field, it is issued assembled in the shell as a component of the complete round. To prepare for firing, it is necessary only to remove the safety wire. If the fuze is not to be immediately assembled, a closing plug is screwed into the fuze opening of the shell body.

PARTS OF FUZE PD-M52

1. Safety wire
2. Setback pin
3. Setback pin spring
4. Safety pin recess
5. Safety pin spring
6. Slider
7. Slider spring
8. Slider locking pin
9. Slider locking pin spring
10. Striker
11. Striker spring
12. Firing pin

**Figure 19. Fuze, Point Detonating, M52**

13. Primer
14. Detonator
15. Booster lead

This fuze is classified as bore safe (detonator safe). It is fitted with safety devices which offset the explosive so that premature action of the bursting charge is prevented while the projectile is in the barrel, both before and after firing, if any of the more sensitive elements, primer and/or detonator, malfunction.

The safety wire is inserted through the body of the fuze and the setback pin, locking all the moving parts in their safe position. The safety wire is pulled just before firing.

The setback pin, held in place by the safety wire, locks the safety pin in position. The setback pin is supported by a spring and held in a recess in the safety pin. The safety pin is locked in the body of the fuze until the setback pin moves out of the recess.

The safety pin is the main locking device of the fuze. It holds the slider in its retracted position and prevents premature alignment of the primer and the detonator with the firing pin and booster lead.

FUNCTIONING OF THE FUZE

PD-M52

Removing the safety wire just before firing is the first step in arming. The shell, inserted in the barrel, slides down until the primer of the ignition cartridge strikes the firing pin in the breech of the mortar.

The combined forces of the shell striking the breech and the blow delivered to the shell by the propelling gases cause:

(a) the inertia of the setback pin to overcome the resistance of the setback pin spring.

(b) This permits the setback pin to move towards the base of the fuze.

(c) This movement withdraws the shank of the setback pin from the recess in the safety pin. The safety pin, released by the setback pin, is

(d) thrown outward by the action of the safety pin spring but is prevented from leaving the fuze by

(e) the wall of the barrel. At the same time, the safety pin is not moved far enough to disengage the slider, and it remains locked in its unarmed position.

When the shell passes the muzzle and the restraint on the safety pin is released.

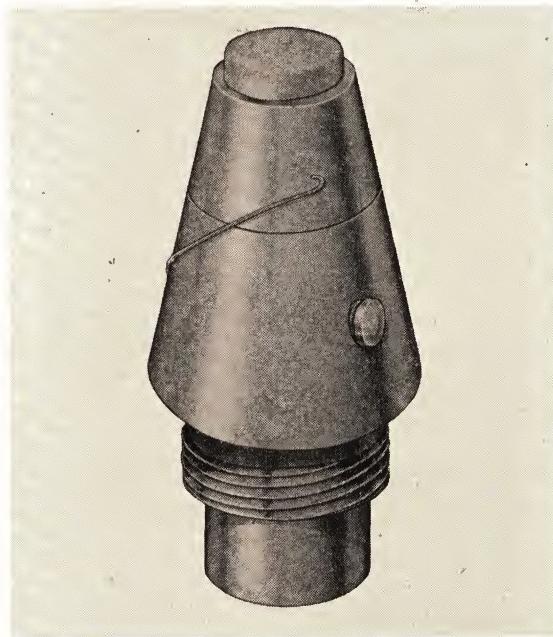


Figure 20. Exterior View, Fuze PD-M52

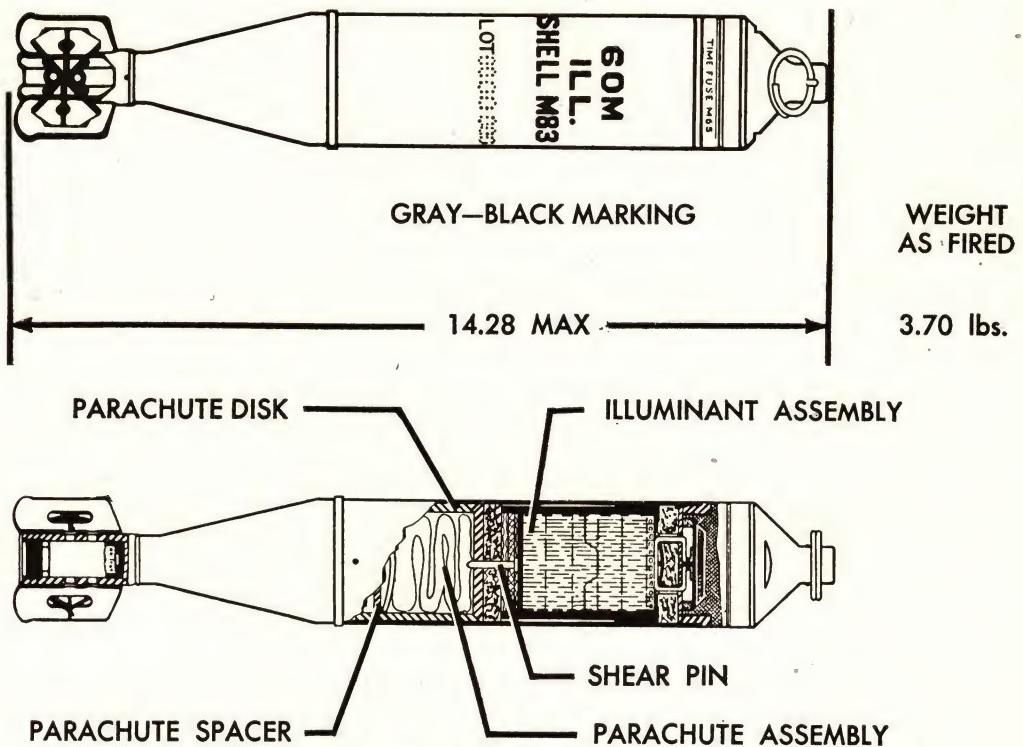


Figure 21. 60-mm Illuminating Shell M83

- (f) The pin and spring fly out of the fuze,
- (g) releasing the slider. Under the action of the slider spring, the slider is forced to the opposite end of its chamber.
- (h) The slider locking pin, pressed upward by its spring and guided by a groove in the lower surface of the slider, is lined up with a recess in the slider.
- (i) The slider spring forces the locking pin into the recess, locking the slider and completing the powder train.

ACTION OF FUZE ON IMPACT

When the shell hits the ground:

- (a) The striker and the spring are compressed which
- (b) drives the firing pin into the primer of the slider.

(c) The flash from the primer ignites the detonator, which in turn

(d) explodes the booster lead and the booster charge, which

(e) detonates the TNT filler in the body of the shell, causing

(f) bursting and fragmentation of the shell.

60-MM ILLUMINATING SHELL M83

This shell provides a light that can be fired from a standard infantry weapon. The flare, of 100,000 candle power minimum, is expelled from the shell 14 seconds after firing. It burns for 25 seconds while falling from a height of approximately 400 feet. The parachute housing makes the shell longer than the other 60-mm ammunition.

FIN ASSEMBLY

The standard fin assembly is used, but there is no increment holder. The increments are held in place by wedging the corners into the fin blade slots. The propellant is the same as that used in the HE

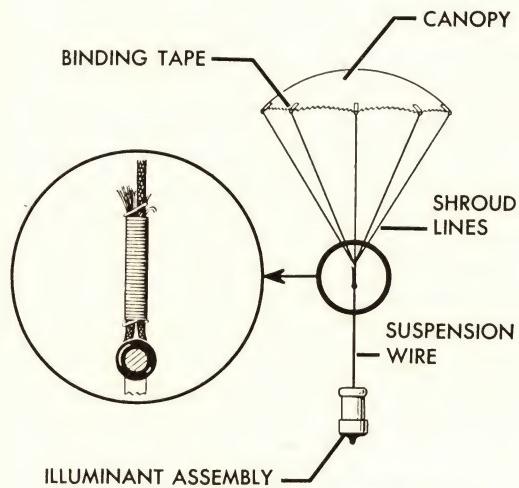


Figure 22. Parachute Assembly

shell, but the complete increment weighs 28 grains as compared to the 35 grains of the HE shell.

ILLUMINATING SHELL M83

The body tube assembly and a tail assembly, fitted together by a coupling and held by four shear pins, form the body. The body tube assembly is a steel tube, to which is welded a steel adapter that seats the fuze.

ILLUMINANT ASSEMBLY

The cardboard tube which fits into the body is the functional part of the shell.

Its front face is in contact with the fuzes. The illuminant composition in the first fire charge is difficult to ignite; therefore, a quick match and the first fire charge are set up in series to insure its ignition. The priming charge is located just above the first fire charge.

PARACHUTE ASSEMBLY

This is made up of a canopy with shroud lines joined through the flare assembly loop, tied and held by reinforcing tape. In assembly, the canopy is folded and inserted into the parachute case, with the top first

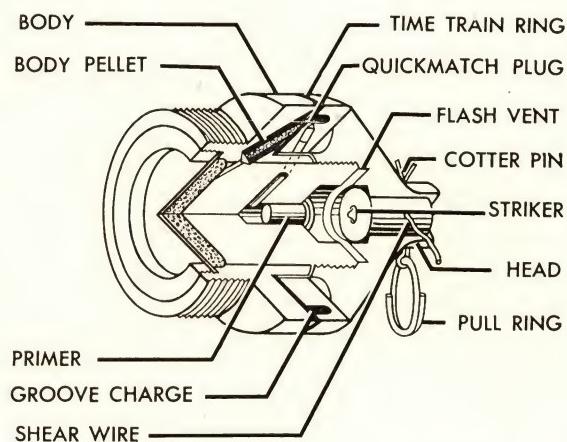


Figure 23. Powder-Train Time Fuze M65

and the suspension cord up. This cord is fastened to the loop on the end of the suspension wire, joining the parachute assembly to the illuminant assembly.

When the illuminant assembly is in the body case, the suspension wire is coiled in the bottom of the parachute case, separated from the canopy by an oilskin paper separator.

THE FUZE M65

This is a powder-train time fuze, with a fixed burning time. The body is aluminum alloy, die-cast to the shape shown. The upper projection has threads to take the head, and the primer is placed in a drilled recess. A flash vent for the powder train is formed by the meeting of the primer recess continuation and a hole drilled through the wall of the time train ring recess. This hole is drilled to receive a body powder pellet. The groove houses the groove charge of 60 grains of fuze powder.

The head of the fuze has two functions: first, to house the striker and second, to hold the time train ring in place. The striker is held in by a cotter pin. This is removable and is withdrawn by putting on the ring. The cotter pin is withdrawn, arming the fuze, just before loading the shell into the barrel.

ACTION OF THE ILLUMINATING SHELL

- (a) The cotter pin is removed from the fuze and the round is dropped down the barrel.
- (b) The round is propelled the same as the high explosive shell.

(c) Setback causes the striker of the fuze to shear the wire and move to the rear and hit the primer.

(d) The primer detonates, and the flash in turn ignites the quick match and the time train groove charge, which has a burning time of $14\frac{3}{4}$ seconds. The fixed burning time of the fuze permits the round, fired with full increment charge, to be at its greatest range and height when the fuze has completed its action. When the flame from the groove charge has completed its circle around the time train ring, it ignites:

(e) the body pellet and pellet charge. The pellet charge ignites:

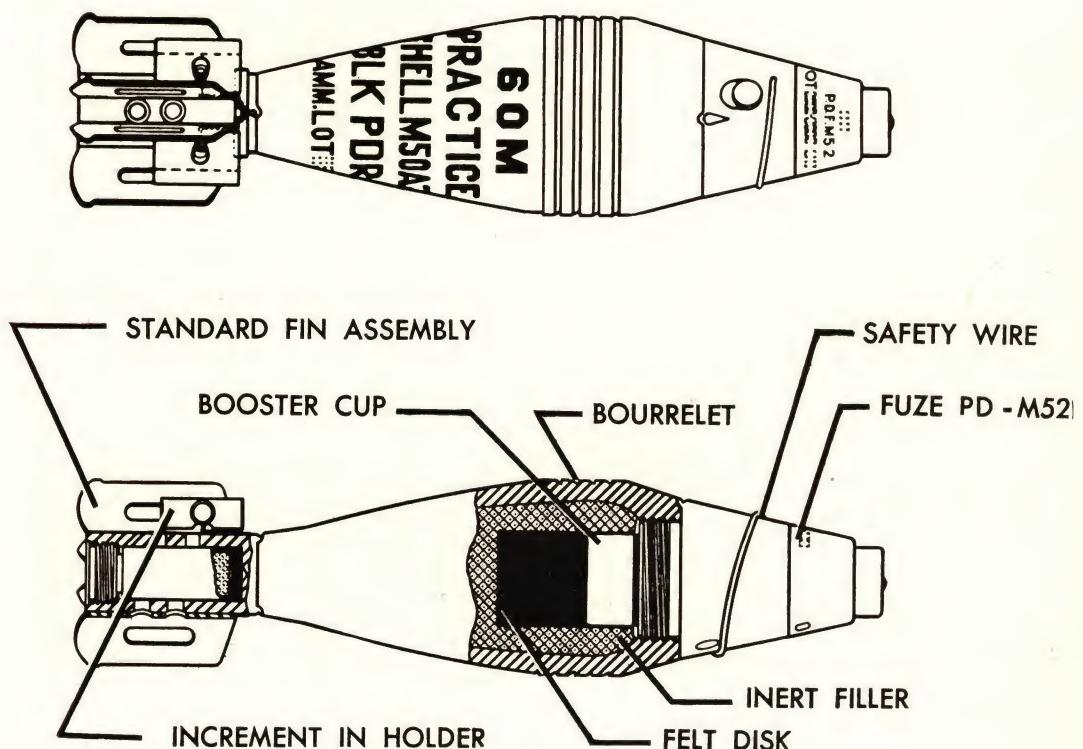
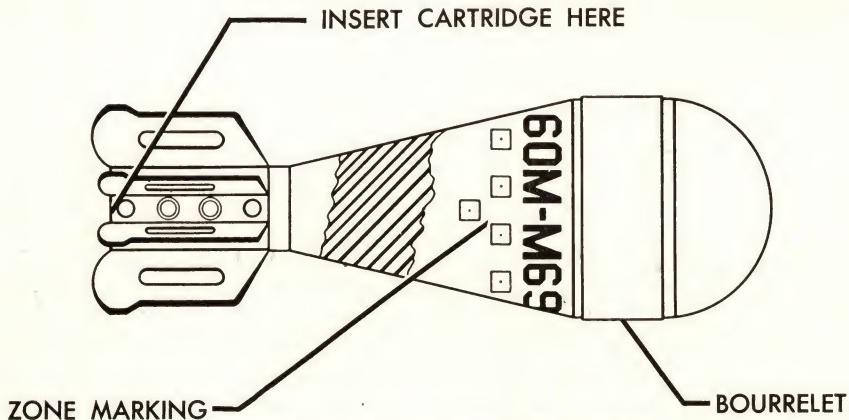


Figure 24. 60-mm Practice Shell M50A2

AMMUNITION**Figure 25. 60-mm Training Shell M69**

(f) the expelling charge in the fuze. This charge has two functions: first, to ignite the quick match and second, to expel the flare assembly. Expulsion is accomplished by the expelling gases acting forcibly against the steel quick match disc. The shock breaks

(g) the shear pins holding the body tube to the tail assembly. When these pins shear,

(h) the flare assembly is expelled from the body tube and

(i) the tail assembly and body tube fall free. As the flare assembly with the parachute assembly attached is forced out of the body case, it falls free and

(j) the parachute unfolds and checks the descent of the illuminant case.

(k) The flame from the expelling charge has ignited the quick match in the flare assembly, which ignites

(l) the primer, which in turn ignites the first fire and the illuminant charge. The burning of the illuminant charge ignites

(m) the illuminant case, which burns slowly enough to support the charge while it is burning.

PRACTICE SHELL M50A2

This shell is designed to give mortar practice in firing without the dangers or expense of the high explosive round. On impact, the shell releases a puff of white smoke which is clearly visible to the observer.

The practice round is similar to the HE round, except for the external markings, the color, and the explosive charge. It has the same dimensions, is the same weight, and is assembled of the same components.

EXPLOSIVE CHARGE

The explosive charge, which produces the smoke puff, is a pellet of black powder, weighing approximately 391 grains. The powder fits into a well formed in the inert material that fills the body cavity. About $\frac{5}{8}$ of the well is occupied by the pellet, the remainder by the booster cup. The inert material is used to provide a housing for the pellet and the booster cup and also to bring the shell to the weight of Shell HE-M49A2.

The shell burst is not the same as that of the HE round. The black powder pellet causes fragmentation of the shell body, but the fragments are of considerable size. Because of their size and low velocity, they are not casualty-producing beyond a short radius of burst.

TRAINING SHELL M69

The Training Shell M69 provides mortar crews training in loading and handling ammunition. The round is assembled with the Ignition Cartridge M4, which is the only propellant for the shell.

The Ignition Cartridge M4 differs from

the Cartridge M5 assembled in the other types of round. The Cartridge M4 consists of a body assembly, a commercial primer, and a powder charge. The primer is made of mercury fulminate, antimony sulphide, potassium chlorate, and ground glass. The effective surface of the primer exposed to the firing pin must have a diameter of 0.2 inch.

SHELL WEIGHT

The shell body varies in weight from 3.83 to 4.07 lb. This difference in weight is broken down into a series of weight zones, as listed in the following table.

| Zones | Over Pounds | Up to and Including | Marking |
|-------|----------------|------------------------|---------|
| 1 | 3.83 | 3.86 | - |
| 2 | 3.86 | 3.90 | -- |
| 3 | 3.90 | 3.93 | --- |
| 4 | 3.93 | 3.97 | ---- |
| 5 | 3.97 | 4.00 | ----- |
| 6 | 4.00 | 4.04 | ----- |
| 7 | 4.04 | 4.07 | ----- |

Since rounds of different weight have different ranges when propelled by the standard cartridge, adjustment of the mortar is necessary to secure uniform range. Data for adjustment of the mortar are supplied in a firing table included with the round.

MISFIRES

A misfire occurs when a round is loaded into the barrel but fails to fire. In most cases of misfire, the round strikes the firing pin but fails to function, possibly because of a loose or dirty firing pin. In rare cases, the round may hang in the barrel without striking the pin. When any doubt exists as to whether the round has hit the

firing pin, the gunner may attempt to seat the round by kicking the barrel with his heel. If this is not effective, and battle conditions permit, the mortar crew will wait one minute before removing the round, to avoid possible accidents caused by delayed action of the ignition cartridge.

After the mortar has been fired, the barrel may be excessively hot. Use ammunition bags as required, for protection in handling the heated barrel.

The successive steps required to remove a round after a misfire and to restore the mortar to service condition are:

AMMUNITION

1. Jar the barrel by kicking with the heel one minute after firing.
2. Unlock the mortar from the base.
3. Lift the breech end of the mortar until the round slides slowly to the muzzle end of barrel.
4. Place the thumb of each hand over the muzzle to stop the round as its nose reaches the muzzle.
5. Locate and place the finger over the head of the safety pin in the fuze.
6. Insert the safety wire in the fuze.
7. Remove the round from the barrel.
8. Disposition of faulty ammunition is the cognizance of bomb-disposal personnel. If bomb-disposal personnel is not available, dispose of misfired shells by lowering them gently, tail first, into deep water after the safety wire has been reinserted in the fuze.
9. Lower the mortar and secure to the base plate.

**SAFETY PRECAUTIONS
DURING MISFIRES**

1. Wait one minute before removing a round.
2. Keep hands away from muzzle as much as possible.
3. Use gloves or ammunition bags for protection against the hot barrel.
4. When base of the barrel is lifted, do not lower it below horizontal position until round has been removed from the barrel.
5. Disposition of faulty ammunition is

under the cognizance of bomb-disposal personnel. If bomb-disposal personnel is not available, dispose of misfired shells by lowering them gently, tail first, into deep water after the safety wire has been reinserted in the fuze.

CARE AND HANDLING

Handle the ammunition with care at all times. The explosive elements in the primers and fuzes are particularly sensitive to undue shock and high temperatures.

No disassembly of the ammunition as issued is authorized. Under no circumstances should disassembly of the fuzes be attempted.

The ammunition should be protected from mud, sand, dirt, water, or any foreign matter.

Do not allow the ammunition to be exposed to the direct rays of the sun for any length of time. More uniform firing is obtained if the rounds are at the same temperature.

Do not remove the fuze safety wire until just prior to firing.

FIRING

Insert the round into the muzzle end of the mortar, fuze end up. When the projectile is released to slide down the bore, **promptly remove the hand from the muzzle**.

Rounds prepared for firing, but not used, should be returned to their original packing after the safety wires have been reinserted and should be appropriately marked, so that they will be used first in subsequent firing, in order to keep opened ammunition to a minimum.

STOWAGE

Since explosives are adversely affected by moisture and high temperature, this ammunition must be stowed in a dry place out

of the direct rays of the sun and of as even temperature as practicable. Do not break the moisture-resistant seal until the ammunition is to be used.

SAFETY PRECAUTIONS

1. See that the mortar and base adapter are firmly mounted before firing, and inspect during firing to see that all clamp bolts and locking nuts remain tight.
2. See that the bore is thoroughly clean and free from oil before firing.
3. Swab the bore after every five rounds during firing.
4. Before loading see that each shell is clean, particularly the bourrelet.
5. After setting the sight and elevating the barrel, check by sighting along the barrel to see that the path of projectile clears all boat's structure or any other interference.
6. Do not remove the safety wire from the fuze until immediately prior to firing.
7. To prevent bore prematures in firing the 60-mm HE mortar shells fitted with Fuze PD-M52, test the tension of the safety pin spring by pressing and releasing the safety pin. It is important that no attempt be made to crowd in and retain a possibly unseated safety pin during loading. A quick verification of safety pin seating is desired, and this is accomplished by pressing and **releasing** the safety pin. If the safety pin becomes unseated, the round will not be fired but will be placed in a safe location for destruction by ordnance personnel. Extreme care will be taken in handling such rounds, since they are armed and detonation will result if pressure is applied to the firing pin. When testing the safety pin of

the Fuze PD-M52, the shell should be held in a vertical position with the fuze end up.

8. Withdraw the hand to the rear immediately upon releasing the shell into the muzzle during loading.
9. Complete rounds of ammunition must be handled with care at all times, because the explosive elements in the primers and fuzes are particularly sensitive to undue shock.
10. No disassembly of the ammunition as issued is authorized. Under no circumstances is a fuze to be disassembled.
11. Disposition of defective ammunition is under the cognizance of bomb disposal personnel, and all defective ammunition should be turned over to them for handling. If bomb disposal personnel is not available, dispose of defective ammunition as directed in Safety Precaution 15, below.
12. Stow ammunition where it will not be exposed to direct rays of the sun, as the explosive components are sensitive to high temperatures.
13. When firing, insert the round into the mortar, fuze end up.
14. In the event of a misfire, wait one minute; then attempt to seat the round by kicking the barrel with the heel. If this fails to fire the round, wait one minute before attempting to remove the unfired round.

SAFETY PRECAUTIONS

15. To remove an unfired round after the one-minute safety interval, unlock the mortar barrel from the base and lift the breech end up allowing the round to slide slowly to the muzzle end. Place the thumb of each hand over the muzzle end to stop the round. Locate and place a finger over the head of the safety pin in the fuze. Insert the safety wire and remove the round from

the barrel. Turn it over to bomb disposal personnel for disposition. Gloves or an ammunition bag should be used as a protection against the hot barrel if much firing has been done. If bomb disposal personnel is not available, dispose of misfired shells by lowering them gently, tail first, into deep water after the safety wire has been reinserted in the fuze.